DOCUMENT RESUME

ED 454 356 UD 034 286

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TITLE	The Relationships among Achievement, Low Income, and Ethnicity across Six Groups of Washington State Students. Technical Report #1.
INSTITUTION	Seattle Pacific Univ., Lynnwood, WA. Washington School Research Center.
REPORT NO	WSRC-TR-1
PUB DATE	2001-07-00
NOTE	30p.
AVAILABLE FROM	Washington School Research Center, 3500 188th Street, S.W., Suite 328, Lynnwood, WA 98037. Tel: 425-744-0992; Fax: 425-744-1241; Web site: http://www.spu.edu/wsrc.
PUB TYPE	Reports - Research (143)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Academic Achievement; Data Analysis; Elementary Education; *Ethnicity; *Low Income Groups; *Socioeconomic Status
IDENTIFIERS	Washington

ABSTRACT

This study examined the relationships between students' academic achievement, income level, and ethnicity using aggregate school 3rd and 6th grade Iowa Test of Basic Skills scores for 1999 and 2000, 4th grade Washington Assessment of Student Learning (WASL) scores for 1999 and 2000, and 7th grade WASL scores for 1999 for all schools in Washington state. Data analysis indicated that low income explained a much larger percentage of the variance in academic achievement than did ethnicity. Ethnicity explained between 0-6 percent of the variance in academic achievement, after controlling for the contribution of low income. Low income, by contrast, explained between 12-29 percent of the variance in academic achievement. Combined with the finding that ethnicity explains approximately 32.7 percent of the variance in low income, the results suggest that the relationship between ethnicity and academic achievement is mostly indirect. Ethnicity relates to low income, and low income in turn relates to academic achievement. (Contains 14 references.) (SM)

Washington School Research Center

Technical Report #1 – July 2001

The Relationships Among Achievement, Low Income, and Ethnicity Across Six Groups of Washington State Students

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The Washington School Research Center (WSRC) is an independent research and data analysis center within Seattle Pacific University. The Center began in July 2000, funded through a gift from the Bill and Melinda Gates Foundation. Our mission is to conduct sound and objective research on student learning in the public schools, and to make the research findings available for educators, policy makers, and the general public for use in the improvement of schools. We believe that sound data and appropriate data analysis are vital components for the identification of school and classroom practices related to increased student academic achievement.

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The Relationships Among Achievement, Low Income, and Ethnicity

Across Six Groups of Washington State Students

A Technical Report For
The Washington School Research Center

Washington School Research Center

Forward

We are pleased to provide this technical report on the relationships among student achievement, income, and ethnicity as the first publication for Washington Educators by the Washington School Research Center. The questions addressed by these analyses are important considerations for all of us concerned with improving education in the state of Washington. Media reports that highlight the different achievement levels of various ethnic groups of children are common. These differences are a source of great concern among community groups, and rightfully so. Yet, those of us who work with data and statistics on a regular basis are acutely aware of the dangers inherent in reporting group achievement results that consider only one characteristic for creating those groups.

Factors affecting student achievement are varied and complex, and failure to consider multiple factors may lead to erroneous or simplistic answers to very complicated questions. In this report, professors Abbott and Joireman address the question of differences in school level achievement depending on the ethnic composition of the student population, so often reported in the media, while at the same time considering the income levels of the students' families. They begin this effort with a brief review of research conducted elsewhere on this topic, and conclude that previous research has shown that "income is generally a better predictor of student achievement than ethnicity."

Using aggregate school 3rd & 6th grade ITBS test scores for 1999 and 2000, 4th grade WASL scores for 1999 and 2000, and 7th grade WASL scores for 1999 for all schools in the state, Abbott and Joireman examine the relationships among these scores and the percentage of students receiving free or reduced lunch at the school, and the various percentages of students comprising a variety of ethnic groups. Using a statistical procedure called multiple regression, they are able to determine the relative importance of these latter two variables in determining the schools' achievement levels. Their findings? "Across a variety of grades and tests, our results support the conclusion that low income explains a much larger percentage of the variance in academic achievement than ethnicity."

Abbott and Joireman do not say that ethnicity is unimportant or unrelated to achievement, but low income appears to be a much more influential factor. They conclude that, "the relationship between ethnicity and academic achievement is mostly indirect: ethnicity relates to low income and low income relates to academic achievement . . ." In other words, low income is the stronger predictor of school achievement, and non-white families are over-represented among the low incomes. These findings suggest therefore, that schools with predominately white, low income populations have achievement levels more in common with schools with non-white, low income populations than they do with schools with white, high income populations. Conversely, the achievement levels of schools with high income student populations more closely resemble other schools with high income student bodies irrespective of their ethnic composition.

Educators throughout the state, indeed throughout the country, are striving to raise the achievement levels of all students. A student's ethnicity is often an observable student characteristic that is frequently viewed as a determinant of that student's achievement level. However, these and other results suggest that it is the effects of poverty that play a much larger role in a student's chance for success in school, and it is those effects that educators and policy makers should consider first as prevention, intervention, and remedial programs are designed.

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INTRODUCTION

Educators at all levels face challenges to learning that are embedded in the student's background and characteristics, as well as systemic to the particular learning program and leadership system in place in the school. While many of these may never be fully understood, it is important to the success of the educational effort to acknowledge that all students can learn under the proper circumstances. Part of the attempt by educational research programs should be to identify and understand the complex nature of the learning environment, and what salient factors are likely to lead to successful learning experiences.

This technical report is an attempt to do just that. By looking in detail at a set of Washington school data, the report is designed to respond to questions from those who are concerned about student performance, and who have asked specifically about the potential impact of certain variables on student learning. One of these questions concerns the interrelationship of low-income and ethnicity on student achievement. That is, are both low-income and ethnicity equally likely to impact student learning? Or, are the two so intertwined that it is difficult to understand the specific influence of each on student achievement?

In the following pages, we attempt to respond to these questions by reporting on data analyses designed to identify the unique effects of predictor variables on student achievement. These analyses are not intended to be exhaustive or definitive with respect to these questions, but rather to add to an existing inquiry by other researchers. The body of existing research will be examined for trends that might be supported or contradicted by the data analyses in this Technical Report.

It is important at the outset to point out what a technical report is not. It is not designed to be a comprehensive analysis of all possible determinants of student achievement. Cataloging the entire range of influence on achievement would be an unrealistic goal of any research program. Additionally, a technical report oftentimes cannot hope to generalize the findings of research beyond the database used in the analysis due to the nature of the limitations of the database itself (e.g., using data that have already been defined and collected, or that may not perfectly operationalize a research construct).

Because the focus of the technical report is on the technical detail of the data, there is no attempt to use the information gained to drive or change policy recommendations. Rather, the attempt is simply to report what is discovered in the hopes that the findings will help to clarify factors non-conducive to learning, and those that might be useful in broader efforts to

improve learning. No claims are made that the analyses will resolve the longstanding, and oftentimes highly charged, debates about the roles of ethnicity and poverty in learning.

Two large-scale studies point to the importance of studying further the relationship between ethnicity and low income. As part of Jencks and Phillips', The Black-White Test Score Gap (1998), Hedges and Nowell suggest that socioeconomic factors affect the Black-White gap in test scores, but cannot entirely explain the "black-white test score convergence" (p. 167). While the current technical report does not address the Black-White test score gap specifically, it does focus on what possible impact ethnicity might have on achievement, taking income into account. In this way, it may contribute to a broader understanding of the dynamics that affect all ethnic groups.

Reaching the Top, the recently published Report of the National Task Force on Minority High Achievement (1999), is an excellent attempt to summarize the thinking and dialog on the overall issue of minority achievement. While reactions to this document are diverse (for example, see the symposium reactions in Society, July/August, 2000), and are as often filled with invective as with praise, it is apparent that further research-based efforts are needed to address the complexity of the ethnicity-poverty relationship. Hopefully, this technical report will be a contribution to that end.

Related Research Literature

Taken together, the recent research literature examining the unique effects of low income and ethnicity on student achievement is not conclusive. In many cases, the statistical analyses are not pointed toward disentangling the separate effects of the variables, and/or the overall research problems encompass other targets. However, the few carefully conducted studies we highlight suggest that, when studied together, low income is generally a better predictor of student achievement than ethnicity.

In some cases, low income and/or ethnicity may appear to be meaningfully related to student achievement when examined individually (Wong and Alkins, 1999; Yellin and Koetting, 1991; Fenwick, 1996). This may be due to the fact that poverty and ethnicity are often coterminous. That is, students of some ethnic backgrounds also may be those who are unequally represented in low-income families. However, the specific contribution of each of these to an understanding of achievement may be confounded by their interrelationship to one another (Patterson, et. al.,

1990). For this reason, it is important to move beyond univariate analyses, or more general attempts, and examine the contribution of each predictor variable with student achievement when the other predictor is present in the analysis. (Dulaney and Banks' 1994 descriptive study is a helpful step in this respect.)

Some insight into this matter is found through studies that attempt to understand the relationship between student achievement and independent factors other than income and ethnicity. Desimone's (1999) study, for example, concluded that there were statistically significant and meaningful differences between parent involvement and achievement, according to race-ethnicity and family income. However, the unique contributions of race-ethnicity and family income upon achievement were not fully elaborated. This was also the case in Johnson's (2000) study of peer effects, and reports examining student mobility (Bolinger and Gilman, 1997) and curriculum alignment (Mitchell, 1999).

More compelling evidence of the specific impact of ethnicity and income on achievement is provided by studies that are statistically tailored and/or expressly focused on the interrelationships of these key variables. Most all of these indicate that income provides the greatest impact on student achievement when the effects of ethnicity are taken into account. Peng and Wright's (1994) analysis of academic achievement, home environments (including family income), educational activities, and ethnicity, concluded that when all variables were included in the analysis, ethnicity accounted for only a very small proportion of the variance (3%) in student achievement. Home environment and educational activities explained the greatest amount of variance (although the specific impact of income was not disaggregated from this group of variables).

The study by Patterson, et. al. (1990) cited earlier, provides another carefully controlled analysis of poverty and ethnicity (along with gender and household composition) as they relate to school-based competence (i.e., conduct, peer relations, and academic achievement). While ethnicity was cited as a strong predictor of achievement, income level and gender emerged as stronger overall predictors of the dependent variables, with income level the strongest predictor of achievement.

Two additional studies point to the importance of income in explaining achievement relative to ethnicity. Miller-Whitehead's (1999) study using hierarchical regression concluded that free/reduced lunch status accounted for the majority of unexplained variance in science scale scores across grades 3 through 8. With grade 5 data, class size accounted for the greatest amount of the explained variability of science scores, while ethnicity was considered "marginally significant" (p.16), with free/reduced lunch status having little direct effect. The author concluded that the latter

findings might be explained by the programs put in place in Tennessee schools to improve science achievement in fifth grade among low-income students. In examining alternative assessment methods in elementary science, Saturnelli and Repa (1995) conclude, with respect to the question of whether race or economic status has the greater effect on science and math achievement, "based on the results of this study, it appears that for science, the answer is economic status. Within each racial group, test scores were found to increase significantly from high-poverty to no-poverty levels (p.34)."

METHOD

Aggregation and Selection of Schools

The analyses presented in this report are based on aggregated, 1999 and 2000 school-level data obtained from the Washington State Office of the Superintendent of Public Instruction. Combining individual student responses within schools was necessary, as information about low income (i.e., percentage of students on free lunch) was only available for each school. Schools with less than ten students were excluded from the analyses since such cases would provide a less credible basis for a stable set of results. To examine the stability and generalizability of the findings, we examined the relationships among low income, ethnicity, and academic achievement within six groups (3 grade levels x 2 achievement tests).

Measures of Low income, Ethnicity, and Academic Achievement

Consistent with past research, low income was defined as the percentage of students in a given school who were on free or reduced lunch. While the percentage of students on free/reduced lunch is not a direct measure of low income, it is at present the best existing measure, and it is used extensively throughout comparable research literature.

Across the six groups, six categories of ethnicity were identified, including Native/American Indian, Asian American, African American/Black, Hispanic, White, and Multi-Racial. For the purposes of our analyses, ethnicity was defined as the percentage of White students in a school. Obviously, this index does not allow for an evaluation of how different distributions of minority groups may relate to achievement. To be sure we were not overlooking potentially important information about such differences, we conducted a series of preliminary analyses incorporating

the percentage of students in additional ethnic categories. Results from these analyses indicated that the inclusion of additional ethnic categories did not aid in the prediction of achievement.[1] As a result, analyses of additional ethnic categories are not included in our report.

Academic achievement was assessed by using two statewide tests including the Washington Assessment of Student Learning (WASL) and the Iowa Test of Basic Skills (ITBS). Both tests contain scales assessing learning within four general domains. The WASL's four general domains include reading, math, listening, and writing. The ITBS's four general domains include reading, math, language (spelling, punctuation), and vocabulary.[2] Within these domains, both tests also contain more narrowly defined subscales. The present report focuses on the relationships among low income, ethnicity, and achievement in the broader learning domains. Future reports could focus on the relationships among low income, ethnicity, and achievement within the more narrowly defined domains.

RESULTS

Group Characteristics

Key characteristics of the six groups, including number of districts and schools, distribution of ethnic groups, as well as means and standard deviations for the various achievement tests are summarized in Tables 1 (WASL) and 2 (ITBS).

Relationship of Low income and Ethnicity to Achievement: Theoretical Models and Data Analytic Strategy

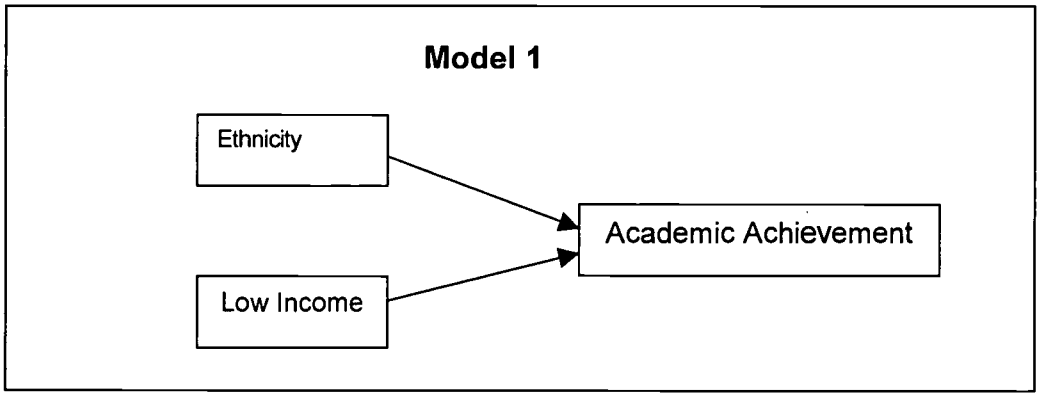
As noted in the introduction, the primary goal of the current report is to determine the relative contribution of low income and ethnicity to

[1] Preliminary analyses were run on the WASL only. Separate analyses were run for each additional ethnic category, adding the category in question, over and above low income and percentage of white students. With the exception of the percentage of Asian Americans, the additional ethnic categories failed to reach statistical significance. The percentage of Asian Americans showed a significant positive relationship with achievement, over and above low income and percent white. While statistically significant, the addition of this variable (% of Asian students) explained a relatively small percentage of the variance in achievement, ranging from 1.2% for WASL-Listening to 5.2% for WASL-Writing. As such, the addition of this variable would have a negligible practical impact on the findings presented in this report.

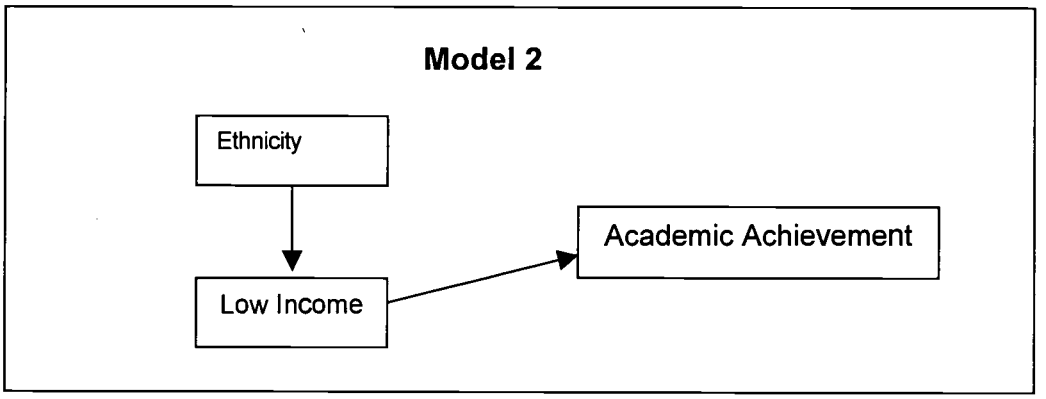
[2] For more information on administration of the WASL and ITBS in Washington, visit www.k12.wa.us/assessment/WASLintro.asp. For more technical information on the WASL, visit www.k12.wa.us/assessment/qawasl.asp. For more technical information on the ITBS, visit www.riverpub.com/products/group/itbs.htm.

academic achievement. To evaluate the relationships among low income, ethnicity, and academic achievement, we conducted a series of multiple regression analyses. To set up the logic of these analyses, we begin by discussing three possible models, which may explain the relationships among ethnicity, low income, and academic achievement. These models, shown below, serve as a guide to the analyses included in this report.

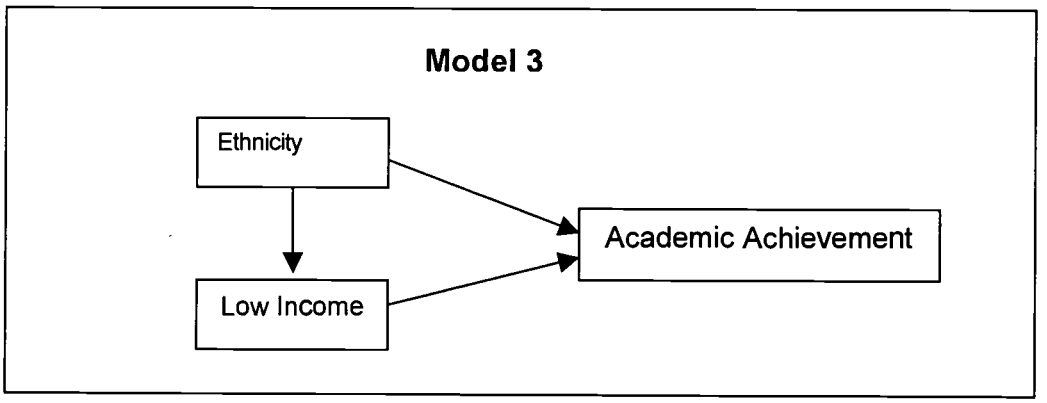
Model 1, shown below, assumes that the two-predictor variables, ethnicity and low income, are each related to academic achievement directly. If true, the simple correlation of ethnicity and low income, respectively, with academic achievement should not change dramatically when the other predictor variable is taken into account. That is, the predictor variables (ethnicity and low income) should each have a sizeable and unique relationship with academic achievement, once the other predictor variable has been statistically controlled.



Model 2, shown below, assumes that ethnicity is related to academic achievement indirectly through its relationship to low income. Four conditions must be met for this model to receive support. First, ethnicity must be related to achievement (without low income in the model). Second, ethnicity must be related to low income. Third, low income must be related to academic achievement (without ethnicity in the model). Fourth, ethnicity's relationship with academic achievement should no longer be "significant," once the effect of low income on academic achievement has been statistically controlled.



Model 3, shown below, assumes that ethnicity is related to academic achievement both indirectly, through its relationship to low income (as in Model 2), and directly, over and above its effect on low income (as in Model 1). Four conditions must be met for this model to receive support. First, ethnicity must be related to achievement (without low income in the model). Second, ethnicity must be related to low income. Third, low income must be related to academic achievement (without ethnicity in the model). Fourth, ethnicity's relationship with academic achievement should remain "significant," once the effect of low income on academic achievement has been statistically controlled.



Model 2 vs. Model 3: The only difference between Models 2 and 3 is that Model 2 assumes that ethnicity is not a significant predictor of achievement, over and above the effect of low income, whereas Model 3 requires ethnicity to be a "significant" predictor of academic achievement, over and above the effect of low income. Choosing between Models 2 and 3 will therefore depend on how the term "significant" predictor is

defined. A complete picture of whether a result is "significant" requires an evaluation of both its statistical and practical significance.

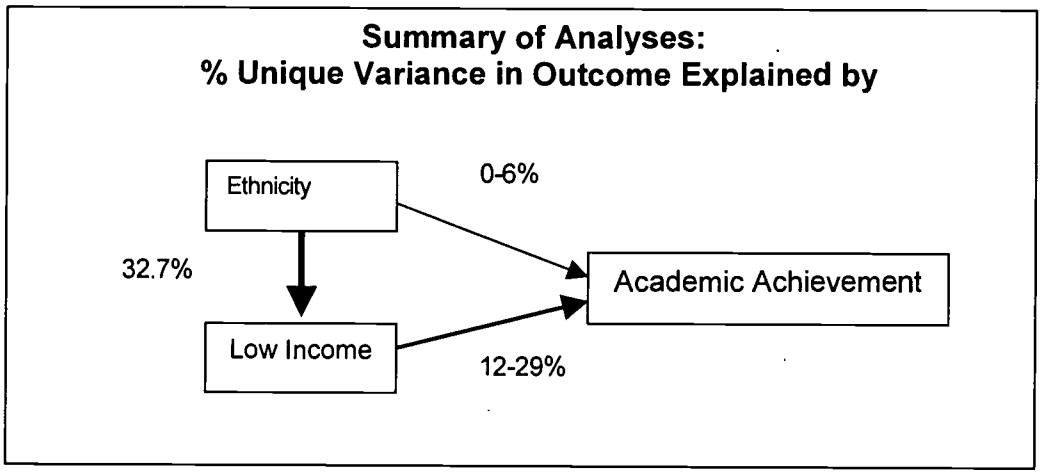
Statistical significance refers to the probability that any given result is due to chance. Traditionally, if this probability is less than 5%, researchers conclude that the result is unlikely to have occurred by chance, and consequently say that the result is "statistically significant." While statistical significance is an important benchmark in evaluating whether a result is likely to be due to chance, it can also be misleading if it is used as the only basis for determining whether a result is "significant" in the broader sense. One of the biggest problems with statistical significance is that it is heavily influenced by sample size. All things being equal, larger sample sizes will produce more statistically significant findings. In the case of very large sample sizes, even relatively small relationships will be "statistically significant." Because most of our analyses are based on more than 1000 schools, there is a good chance that even very small relationships will be statistically significant. As such, we will place more emphasis on the practical significance of the findings.

Practical significance refers to the size of any given result. Given the nature of our data, the size of any given result can be gauged in terms of the percentage of variance in academic achievement explained by low income and ethnicity, respectively. As discussed below, our analyses reveal that, overall, low income and ethnicity together typically explain between 40% and 60% of the variance in academic achievement, depending on the grade and achievement test in question. While this is useful information, our central goal is to understand how much of the overall variance in academic achievement is uniquely due to ethnicity and low income, respectively. Returning to the Models 2 and 3, the central question is whether ethnicity uniquely explains a practically significant amount of the variance in academic achievement, over and above the influence of low income. We address this question, and evaluate Models 1-3, in the next section of this report.

Multiple Regression Analyses: Summary of Findings

To aid in the discussion of our findings, we present a brief summary of our results before moving into the details of the various analyses. In terms of the three models outlined earlier, the results of our analyses are most consistent with a weak version of Model 3, as depicted in the diagram below. Of the two predictors, low income is clearly the strongest, uniquely explaining 12 to 29% of the variance in achievement, depending on the grade and test. By comparison, ethnicity uniquely explains a much smaller 0 to 6% of the variance in achievement, again depending on the grade and test. Additional analyses indicate that ethnicity explains, on

average, 32.76% of the variance in low income (average correlation, r = -.57). In summary, our results suggest that the relationship between ethnicity and academic achievement is mostly indirect: ethnicity is related to low income, which in turn is related to academic achievement, though ethnicity does show a small direct relationship with academic achievement, over and above the effect of low income. Restated, of the two predictor variables, low income is the most closely related to academic achievement, irrespective of ethnicity. More detail regarding these findings is presented in the next section.



Multiple Regression Analyses: Detailed Findings

To evaluate the relationships among low income, ethnicity, and academic achievement, we conducted a series of 24 multiple regression analyses (3 grades x 2 achievement tests x 4 achievement test subscales). Within each analysis, low income (% of students in a school on free/reduced lunch) and ethnicity (% of white students in a school) were entered as a set. Preliminary analyses indicated that the percentage of students in additional ethnic categories did not aid greatly in the prediction of achievement, over and above low income and the percentage of white students (see Footnote 1). As a result, the percentage of students in additional ethnic categories was not included in the analyses reported below. Results from the 24 multiple regression analyses are summarized in Tables 3 (WASL) and 4 (ITBS).

We begin a discussion of the results in the top left portion of Table 3. This section summarizes the relationships among low income (% students on free lunch), ethnicity (% of white students), and reading scores on the

WASL for 4th grade tested in 1999 (WASL-4-99). Several aspects of these results deserve comment.

First, shown under the heading R^2 – Tot is the total variance in WASL-4-99 reading scores that is explained by low income and ethnicity as a set. These values have a possible range from 0 (0%) to 1 (100%). As can be seen in the table, over half of the variance in WASL-4-99 reading scores (55%) is explained by low income and ethnicity together as a set.

Second, shown under the heading R are the simple Pearson-Product Moment correlations between reading scores and each predictor variable. These values range from –1 (perfect negative relationship) to + 1 (perfect positive relationship). As can be seen, reading scores are negatively correlated with the percentage of students on free lunch in a given school (r = -.72), and positively correlated with the percentage of white students in a given school (r = .57). In other words, reading scores are lower in schools with a higher percentage of students on free lunch, and they are higher in schools with a higher percentage of white students.

Third, shown under the heading R^2 – Ch is the percentage of variance in reading scores that is uniquely accounted for by each predictor variable (low income and ethnicity).[3] In theory, these values have a possible range from 0 (0% unique variance) to 1 (100% unique variance). This is arguably the most important part of the output, as it directly addresses the question of whether ethnicity predicts achievement, over and above the effect of low income. As can be seen in the table, the R^2 – Ch values indicate that low income uniquely explains 23% of the variance in reading scores, while ethnicity uniquely explains only 3% of the variance in reading scores.[4] In other words, once low income is taken into account, ethnicity explains very little additional variance in reading scores. Based on these results, the most important predictor of reading scores is low income. Given the possible range for these values (0-100%), it may not appear very impressive that low income explains only 23% of the variance in reading scores. Indeed, that leaves 77% of the variance in reading scores unexplained. However, by many behavioral research standards,

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[3] R^2 – Ch (i.e., R^2 change values) were computed by squaring the part correlation for each predictor variable. Identical values could have been obtained by conducting hierarchical multiple regression analyses in which we evaluated the percentage of variance each predictor added to the model, once the other predictor had been statistically controlled (i.e., R^2 change for the predictor entered into the model on the second step).

[4] It will be noted that the sum of these unique variances (26%) is less than the R^2-Tot (55%) discussed earlier. This is due to the fact that the unique variances do not take into account "shared variance", or variance in reading scores which is explained by low income and ethnicity, but which cannot be uniquely attributed to either variable.

23% is an impressive (practically significant) finding for a single predictor variable.

Finally, shown under the column B are the unstandardized regression coefficients. Interested readers may use the unstandardized regression coefficients to predict WASL-4-99 reading scores by inserting relevant values for low income and ethnicity into a three-parameter regression model. For example, assume a school in question has 40% of its students on free/reduced lunch (B = .40), and is composed of 50% white students (B = .50). Using this information, the predicted WASL-4-99 reading score for that school would be 398.649: Predicted Reading Score = 406.27 + (-19.14 x .40) + (.07 x .50) = 406.27 + (-7.656) + (.035) = 398.649. This compares to the average WASL-4-99 reading score of 403.99 (shown in Table 1).

Having described in detail the various portions of the output for WASL-4-99 reading scores, we now proceed to a more general discussion of the results. Because reading and math scores are the most comparable subscales on the WASL and ITBS, we focus our discussion primarily on these two domains.

Comparing the results of the various regression analyses, several patterns seem worth mentioning. First, an examination of the R^2 - Tot values reveals that low income and ethnicity as a set tend to explain more of the variance in reading scores (average = 55.8%) than in math scores (average = 45.7%). Second, and more important, an examination of the R^2 - Ch values reveals that across all six groups, low income uniquely explains a much larger percentage of the variance in reading and math scores when compared to ethnicity. Averaging across grade levels and tests (WASL, ITBS), low income explains 24% of the variance in reading and 21.2% of the variance in math. By contrast, ethnicity explains only 3.5% of the variance in reading and only 2% of the variance in math. Reframed, low income explains 6.9 times more variance in reading, and 10.6 times more variance in math, when compared to ethnicity. Third, additional comparisons of the R^2 - Ch values on the WASL reading and math scores reveals a small trend for low income to become somewhat less important from 4th to 7th grade (21.5% to 17%), and ethnicity to become somewhat more important from 4th to 7th grade (3% to 4.5%).

We now turn our attention to the remaining tests on the WASL (Listening and Writing) and ITBS (Language and Vocabulary). With regard to the WASL, and averaging over groups, it is apparent that, as a set, low income and ethnicity explain more of the overall variance (R^2 – Tot) in listening (47%) than in writing (36%). Focusing on the unique relationships (R^2 – Ch), it is apparent that low income explains relatively more of the variance in writing (19.5%) than in listening (15.3%), whereas

ethnicity explains relatively more of the variance in listening (4.7%) than in writing (0.5%). Turning to the ITBS, and averaging over groups, it is apparent that, as a set, low income and ethnicity explain more of the overall variance in vocabulary (58.6%) than in language (32%). Similarly, low income and ethnicity each tend to explain more of the unique variance in vocabulary (25.3%, 4.3%) than in language (20.3%, 0.7%).

In summarizing these various findings, it is clear across a variety of grade levels, instruments (WASL, ITBS), and subscales on those instruments that low income explains the bulk of the variance in academic achievement (12-29%) when compared to ethnicity (0-6%). Additional analyses indicate that ethnicity explains over a third of the variance in low income (32.7%). Taken together, these results most strongly support a weak version of Model 3. That is to say, the relationship between ethnicity and academic achievement appears to be mostly indirect: ethnicity is related to low income, which in turn is related to academic achievement, though ethnicity does show a small direct relationship with academic achievement, over and above the effect of low income.

DISCUSSION

The primary goal of this investigation was to evaluate the unique contribution of low income and ethnicity to academic achievement. Across a variety of grades and tests, our results support the conclusion that low income explains a much larger percentage of the variance in academic achievement than ethnicity. This is not to say that ethnicity is unrelated to academic achievement. Indeed, it is. The question is whether ethnicity influences academic achievement over and above the effects of low income. In response to that question, our results indicate that ethnicity explains between 0 to 6% of the variance in academic achievement, after the contribution of low income has been statistically controlled. Low income, by contrast, explains between 12 and 29% of the variance in academic achievement. Combined with the finding that ethnicity explains approximately 32.7% of the variance in low income, our results suggest that the relationship between ethnicity and academic achievement is mostly indirect: ethnicity relates to low income, and low income in turn relates to academic achievement (a weak version of Model 3, outlined earlier).

Before concluding, several limitations of the current report should be mentioned. First, because our analyses focused on aggregated, group-level data, the findings in this report, while suggestive, cannot be directly

generalized to individual students.[5] Future research using student-level data could help clarify whether these results generalize to that level. Second, while low income and ethnicity together explained a relatively high percentage of the variance in most of the outcome measures, a sizable percentage of the variance in achievement scores could not be accounted for by these variables. For example, 44.2% of the variance in reading, and 54.3% of the variance in math, was unexplained by low income and ethnicity as a set. This clearly indicates that additional variables contribute to achievement within these domains. Future research should take these into account as a way of further explaining variations in student achievement.

Finally, the data presented here are correlational in nature. As with any correlational data, it is important to recognize that these data do not conclusively prove causation. While certain causal alternatives can be eliminated (e.g., academic achievement cannot influence ethnicity), there may be several different explanations for the relationships demonstrated here. In this regard, one important set of questions focuses on <u>why</u> low income is related to academic achievement (i.e., what mediates the relationship between low income and academic achievement?). To the extent that these mediating variables can be the target of interventions within or outside the schools, it may be possible to reduce the relationship between low income and academic achievement.

[5] This technical report addresses aggregated (school level) data from the State of Washington. Analyses based on schools within individual districts generally reflect the overall study findings, but may show some slight discrepancies due to sample size or unique factors within the district. Subsequent exploration based on individual student-level data, when the data are available, will provide further insight into the impact of income and ethnicity on student achievement.

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Table 1

Key Group Characteristics: WASL

Variable	Group														
	WASL-499					WASL-400					WASL-799				
	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Low Income															
% Free Lunch	1042	0.39	0.23	0.00	0.98	1057	0.38	0.23	0.00	1.00	426	0.34	0.20	0.00	0.95
Ethnicity															
American Indian	1058	3.22	7.71	0.00	100.00	1073	3.23	8.73	0.00	100.00	445	4.38	10.93	0.00	100.00
Asian	1058	6.66	8.74	0.00	63.33	1073	6.78	8.47	0.00	66.67	445	4.90	6.63	0.00	45.86
African American	1058	5.50	9.95	0.00	90.38	1073	5.61	10.02	0.00	95.24	445	3.84	8.56	0.00	86.54
Hispanic	1058	8.59	13.97	0.00	84.51	1073	9.42	14.76	0.00	91.43	445	8.44	13.69	0.00	76.81
White	1058	73.45	21.50	0.00	100.00	1073	73.82	21.62	0.00	100.00	445	74.19	21.12	0.00	100.00
WASL Scale															
Reading	1059	403.99	7.46	378.54	435.46	1074	407.07	7.67	381.55	443.60	444	392.18	7.78	364.43	418.35
Math	1059	385.77	15.00	327.95	436.62	1074	390.92	15.07	345.54	453.30	444	361.52	22.96	270.78	471.83
Listening	1059	412.61	17.80	344.15	471.23	1074	411.09	18.77	343.03	474.93	444	441.17	18.65	365.36	536.67
Writing	1059	365.35	19.24	287.53	435.67	Standardized Scores Unavailable					444	364.61	23.46	269.00	442.17

Note. WASL = Washington Assessment of Student Learning test. N = number of schools. SD = standard deviation. Min = minimum. Max = maximum.

Table 2

Key Group Characteristics: ITBS

Variable	Group														
	ITBS-399					ITBS-300					ITBS-600				
	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Low Income															
% Free Lunch	1040	0.40	0.23	0.00	0.98	1055	0.38	0.23	0.00	0.99	707	0.35	0.21	0.00	0.95
Ethnicity															
American Indian	1062	3.01	8.43	0.00	100.00	1077	3.23	9.10	0.00	100.00	735	3.60	9.62	0.00	100.00
Asian	1062	6.52	8.30	0.00	62.34	1077	6.81	8.77	0.00	62.75	735	6.21	7.38	0.00	57.97
African American	1062	5.40	9.61	0.00	90.48	1077	5.70	9.99	0.00	92.86	735	4.21	7.84	0.00	95.83
Hispanic	1062	8.95	14.57	0.00	94.03	1077	9.74	15.44	0.00	90.70	735	7.46	12.67	0.00	90.00
White	1062	74.11	21.61	0.00	100.00	1077	71.74	22.84	0.00	100.00	735	74.81	20.58	0.00	100.00
Multiracial	1062	2.00	4.63	0.00	82.14	1077	0.87	2.70	0.00	30.00	735	1.68	4.62	0.00	45.83
ITBS Scale															
Reading	1062	185.91	7.98	159.58	225.54	1077	186.53	8.01	158.56	225.14	734	228.42	10.97	172.67	275.36
Math	1061	187.20	7.37	165.11	221.92	1077	188.60	7.68	164.59	223.52	734	230.22	10.50	178.57	273.25
Language	714	183.62	9.92	140.00	224.96	783	184.23	11.09	138.00	230.29	733	232.05	13.57	183.50	293.80
Vocabulary	1062	185.14	8.38	156.65	222.51	1077	185.76	8.38	152.78	222.56	734	226.57	10.48	161.83	273.50

Note. ITBS = Iowa Test of Basic Skills. N = number of schools. SD = standard deviation. Min = minimum. Max = maximum.

Table 3

WASL Scores Predicted by Low Income and Percentage of White Students in Three Groups

Outcome / Predictor	Group														
	WASL-499					WASL-400					WASL-799				
	B	Beta	R	R2-Ch	R2-Tot	B	Beta	R	R2-Ch	R2-Tot	B	Beta	R	R2-Ch	R2-Tot
Reading															
Overall Model					.55					.53					.53
Intercept	406.27					408.68					391.57				
% on Free Lunch	-19.14	-0.60	-0.72	0.23		-19.14	-0.58	-0.71	0.21		-20.01	-0.53	-0.69	0.18	
% White	0.07	0.21	0.57	0.03		0.08	0.22	0.56	0.03		0.10	0.27	0.59	0.05	
Math															
Overall Model					.49					.47					.49
Intercept	389.79					394.63					359.31				
% on Free Lunch	-36.18	-0.56	-0.68	0.20		-35.70	-0.55	-0.67	0.19		-56.46	-0.50	-0.66	0.16	
% White	0.14	0.20	0.53	0.03		0.13	0.20	0.52	0.02		0.29	0.26	0.57	0.04	
Listening															
Overall Model					.49					.47					.45
Intercept	412.10					411.48					434.01				
% on Free Lunch	-39.27	-0.51	-0.67	0.17		-41.60	-0.51	-0.66	0.17		-38.70	-0.44	-0.62	0.12	
% White	0.21	0.26	0.57	0.04		0.21	0.24	0.55	0.04		0.26	0.31	0.57	0.06	
Writing															
Overall Model					.36										.36
Intercept	384.56					Standardized Scores Unavailable					371.40				
% on Free Lunch	-50.06	-0.60	-0.60	0.23							-55.71	-0.49	-0.59	0.16	
% White	0.00	**0.01**	0.37	0.00							0.16	0.15	0.45	0.01	

Note. B = unstandardized regression coefficients. R = simple correlation between outcome and denoted variable. R^2-Ch = percentage of variance in outcome variable explained by denoted variable, above and beyond remaining variable. R^2-Tot = total variance explained by low income and percentage of white students as a set. All predictors significant at $p < .01$, with exception of bolded betas.

Table 4

ITBS Scores Predicted by Low Income and Percentage of White Students in Three Groups

Outcome / Predictor	Group														
	ITBS-399					ITBS-300					ITBS-600				
	B	Beta	R	R2-Ch	R2-Tot	B	Beta	R	R2-Ch	R2-Tot	B	Beta	R	R2-Ch	R2-Tot
Reading															
Overall Model					.57					.59					.58
Intercept	189.70					189.87					228.35				
% on Free Lunch	-21.58	-0.64	-0.74	0.26		-21.59	-0.64	-0.75	0.29		-29.13	-0.59	-0.72	0.27	
% White	0.06	0.17	0.56	0.02		0.07	0.19	0.55	0.03		0.13	0.27	0.55	0.05	
Math															
Overall Model					.42					.46					.41
Intercept	194.04					192.98					232.97				
% on Free Lunch	-19.78	-0.63	-0.65	0.25		-19.55	-0.60	-0.67	0.25		-25.89	-0.54	-0.62	0.22	
% White	0.01	0.04	0.42	0.00		0.04	0.13	0.45	0.01		0.08	0.17	0.43	0.02	
Language															
Overall Model					.27					.23					.46
Intercept	195.24					193.55					238.08				
% on Free Lunch	-22.95	-0.56	-0.51	0.19		-23.00	-0.49	-0.48	0.15		-37.23	-0.60	-0.67	0.27	
% White	-0.03	-0.08	0.28	0.00		-0.01	**-0.02**	0.28	0.00		0.09	0.14	0.43	0.02	
Vocabulary															
Overall Model					.58					.60					.58
Intercept	187.17					188.24					225.87				
% on Free Lunch	-21.48	-0.60	-0.74	0.23		-22.07	-0.63	-0.75	0.27		-27.23	-0.59	-0.72	0.26	
% White	0.09	0.22	0.59	0.03		0.08	0.23	0.57	0.04		0.13	0.28	0.57	0.06	

Note. B = unstandardized regression coefficients. R = simple correlation between outcome and denoted variable. R^2-Ch = percentage of variance in outcome variable explained by denoted variable, above and beyond remaining variable. R^2-Tot = total variance explained by low income and percentage of white students as a set. All predictors significant at $p < .01$, with exception of bolded betas.

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